coupled traits coexist in the same community under conditions which preclude all possibility of ascribing one of the traits to an indigenous, the other to an immigrant culture. This being so, what justification is there for advancing such an interpretation in *any* case, unless the assumption can be supported by specific evidence? Obviously, the easier it is to explain a phenomenon in one of two ways, the more vigorous must be the proof if one of the two alternative explanations is selected.

After all, then, there is a close similarity between Rivers of the *Melanesian Society* and Graebner of *Die Melanesische Bogenkultur*. The former author takes special pains (II., 3, *seq.*) to assert his complete independence of Graebnerian method. That the author's position is in part justified, has been shown before. But in one respect the relationship of the two systems is unmistakable. Both authors utilize diffusion not as a process to be demonstrated but as one to be assumed for the purpose of hypothetical culture building. To be sure, what Rivers builds is altogether different from that which is built by Graebner, but the principles according to which the different parts of the structures are welded together are the same in either case.

Before closing it will be well to refer to Dr. Rivers's own definition of his method. We read:

> This method has been the formulation of a working hypothetical scheme to form a framework into which the facts are fitted, and the scheme is regarded as satisfactory only if the facts can thus be fitted so as to form a coherent whole, all parts of which are consistent with one another (II., 586).

The method, thus formulated, is, as a method of historical research, self-condemnatory. It may well be applied in the shaping of those hypothetical conceptual systems which are introduced by the theoreticians of the exact sciences for the purpose of providing a simplified description of the data of experience in a particular field. It does not matter how the vortex looks (or whether it looks at all), if only the functions of the ether can be readily derived from it. It may not be of importance whether the atom exists or not (with apologies to Lord Kelvin), but if it furthers a successful formulation of the facts of chemistry (a task in which of late it has conspicuously failed), its conceptual existence is vindicated. Not so in history. It has been said, with some truth, that for an understanding of society it is less important to know what has occurred than what may have occurred. But surely this does not apply to the study of history as such, nor to ethnology, in so far as its task is historical. Here the search is altogether for what has occurred, although the knowledge of what may have occurred can serve as a useful guide in the search. In the domain of ethnology, moreover, our knowledge of what has occurred will have to be increased many times before we can safely trust our intuitions as to what may have occurred.

To repeat, then, Dr. Rivers has labored fiercely against heavy odds, he has reopened an old and much trodden field; his work emphasizes once more the amazing cultural complexity of those southern seas; it is rich in subtle psychological analysis and happy formulation of theoretical principles; it also abounds in ingenious hypotheses of great *prima facie* plausibility. But we can not endorse this "history" as a model of ethnological method, for *a history* surely it is not.

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SPECIAL ARTICLES

LOBSTER MATING: A MEANS OF CONSERVING THE LOBSTER INDUSTRY

During the summer of 1914 the writer, working under the auspices of the Biological Board of Canada, attempted to rear lobster fry to the crawling stage, using the now familiar apparatus of the Rhode Island Commission. The site chosen for the repetition of the celebrated Wickford experiments was St. Mary's Bay, Digby Co., Nova Scotia. The attempt proved a complete failure due chiefly to the extreme cold water (50° F. to 60° F.) and to the extensive development of diatoms which soon closed up the mouth parts of the fry and caused an exceedingly high death rate.

However, an experiment that was at first supposed to be a very minor one compared with lobster rearing turned out to be the major one. It was this. About the middle of June, 47 females and 15 males (all known as "commercial lobsters," because the females when caught in fishermen's traps have no "berries" on them) were placed in a wooden pound enclosing an area of 10 feet by 20 feet. The slats of which the pound was built were about 4½ feet long, 3 inches wide and 1 inch thick. It was intended to retain the animals over winter for the purpose of elucidating the old question of whether or not adult females moult one year and extrude eggs the next, or whether they extrude eggs every year (when mating conditions are favorable) and only moult occasionally as they grow older.

On the 12th of August the whole of the 62 lobsters were dipped up to see what condition they were in. They all appeared healthy, and 36 per cent. of the females carried eggs. Dr. Herrick in his well-known book on the American lobster quotes from Vinal Edwards to the effect that the percentage of berried lobsters caught by fishermen off the Massachusetts coast was 12 per cent. for the autumn of 1893 to June 30, of 1894. Careful inquiries among both canners and fishermen of the St. Mary's area elicited the information that only about 1 per cent. of the females caught in fishermen's traps carried eggs. And then the question arose: How is it that in fishermen's traps only one female in every hundred carries eggs, whereas in our mating pen thirty-six out of every hundred carry eggs? The problem did not grow any simpler when it was found that by the end of September the percentage in our pen had risen to 64 per cent. The 17 females which did not extrude eggs were removed from the latticed pen and the 30 which bore eggs, representing the 64 per cent., were kept over winter in a compartment by themselves. On April 7, 1915, the 30 were all found to have the full complement of eggs upon them. Subsequently, in June and early July, they all hatched out their eggs, and being kept in compartments by themselves 9 of them were found to have extruded eggs in late July and August. These 9 were removed from the pen, the remaining 21 being retained, but unfortunately one corner of the enclosure gave way, allowing most of the 21 to escape and mingle with others, so that it was impossible to know how many more of them did extrude eggs.

Mating experiments were resumed during the summer of 1915, but were not so successful as those of 1914. Only 40 per cent. of the females extruded eggs, and the eggs were most of them unfertilized. Probably the sole reason for this was lack of males. During the early part of the summer we had only one male to mate with 51 females. Later on, we were fortunate enough to secure 25 more males, but half of these died from accidental poisoning by paint on the inside of our mating pens. Moreover, many of the remaining males were decidedly undersized—9½ to 10 inches in length. But perhaps the most fundamental reason for the poor showing of 1915 lay in the fact that the large majority of the females had been retained in the pound over winter, and as a consequence had suffered considerably in general health. Few of them had moulted and their "shells" were covered with dark brown algal growths that I have always seen upon lobsters when in lengthened confinement, but never upon those which were taken directly from the open sea.

In 1916 the Biological Board authorized an extension of the mating experiments to two other places on the maritime coast, namely, St. Andrew's, New Brunswick, and Pictou, on Northumberland Straits. The results to date are 25 "berried" out of 105 in St. Mary's Bay, 8 out of 22 at St. Andrews and 14 out of 21 at Pictou, or, expressed in percentages, 25 per cent., 36 per cent. and 66 per cent., respectively.

How do these percentages compare with the percentages of females caught in lobster traps in these same areas? Fortunately, through the courtesy of the Department of Naval Service, Ottawa, we were able to make a close approximation to an answer to this question. At the request of the Biological Board, the naturalist of the Fisheries Branch, Mr. Andrew

Halkett, was detailed to spend the summer in going out with lobster fishermen all around the coast, and in collecting statistics as to the total males, total females and percentages of berried females caught in lobster traps. The following is a copy of his summary of results:

Date	Name of Place	No. Males	No. Females	No. Females which Carried Eggs	Remarks by Dr. Knight
April 24, 1916	Tommy's Beach, N.S.	56	58	0	
April 25, 1916	Tommy's Beach, N.S.	26	27	0	
April 28, 1916	Little River, N.S.	23	17	0	
May 2, 1916	Whale Cove, N.S.	25	28	0	
May 3, 1916	White Cove, N.S.	26	19	1	Egg of 1915
May 5, 1916	Tiverton, N.S.	9	20	0	
May 15, 1916	Lunenburg, N.S.	36	35	1	Egg of 1915
May 17, 1916	Port Mouton, N.S.	50	39	3	Eggs of 1915
May 20, 1916	Shag Harbor, N.S.	46	54	0	
May 22, 1916	Shag Harbor, N.S.	88	112	0	
May 23, 1916	Shag Harbor, N.S.	39	70	2	Eggs of 1915
May 24, 1916	Shag Harbor, N.S.	171	158	0	
May 26, 1916	Cape Sable Island, N.S.	68	98	0	
May 30, 1916	Lobster Bay, West Pubnico	82	73	0	
June 2, 1916	Cape St. Mary's, West Pubnico	66	86	0	
June 6, 1916	Mink Cove, N.S.	34	25	1	Egg of 1915
June 10, 1916	Little River, N.S.	24	28	0	
June 12, 1916	Little River, N.S.	14	10	0	
June 15, 1916	Ostrea Lake, N.S.	16	14	0	
June 16, 1916	Jeddore, N.S.	169	191	6	Saw first eggs hatching 1915
June 20, 1916	Pope's Harbour, N.S.	6	6	0	
June 24, 1916	Pugwash, N.S.	366	352	50	9/10 old, 1/10 new eggs
June 28, 1916	Skinner's Reef, N.S.	56	36	1	Egg of 1915
June 29, 1916	Pictou Island, N.S.	24	39	1	New eggs (1916)
July 10, 1916	Northport, N.S.	111	110	10	9 old eggs, 1 new
July 13, 1916	Shemogue, N.B.	108	95	3	1 egg 1915, 2 new
July 17, 1916	Dupin's Corner, N.B.	50	27	1	Egg 1916
July 19, 1916	Cormierville, N.B.	133	105	0	
July 20, 1916	Chockfish River, N.B.	139	119	1	Eggs new
Aug. 1, 1916	Cape Traverse, P.E.I.	157	158	1	Eggs new
Aug. 2, 1916	Cape Traverse, P.E.I.	134	112	2	Last eggs seen hatching
Aug. 4, 1916	Brae Harbour, P.E.I.	164	108	1	New eggs (1916)
Aug. 5, 1916	Rocky Point, P.E.I.	135	77	1	New eggs (1916)
Aug. 7, 1916	Brae Harbour, P.E.I.	207	118	3	New eggs (1916)
Aug. 9, 1916	West Point, P.E.I.	325	274	5	New eggs (1916)
Aug. 10, 1916	Brae Harbour, P.E.I	150	100	3	New eggs (1916)
	Totals.....	3,333	3,004	97 or 3.2%	

Samples of all eggs were sent to me for the determination of the age of the eggs.

Let us compare these results with statistics furnished me by Dr. Hugh M. Smith, the fish commissioner at Washington, as to the number of lobsters taken off the Massachusetts coast.

Dr. Smith is careful to state that the number of berried females is probably understated, because of the carelessness of fishermen in making returns. We are quite certain that the percentages for 1894–95 are too low, because we have Vinal Edwards's catch off Woods Hole already referred to for these same years, showing 12 per cent. of the females as carrying eggs. Does this mean that 88 per cent. of the female lobsters off the Massachusetts coast are sterile? If female lobsters moult every second year and extrude eggs in the alternate years, why do not 50 per cent. of them carry eggs? But they do not, as every fisherman knows.

The fact is that the biennial theory of moulting and spawning can not be held any longer. In the sixties and seventies when about half the females carried eggs (see Vinal Edwards quoted by Herrick in regard to 63.7 per cent. of the females off No Man's Land being ber-

ried) the theory seemed to fit the facts. Today it does not.

Year	No. Lobsters Above 10½ Inches	Egg-bearing Lobsters	Estimated Females—about Half the Total	Percentages of Berried Females
1888	1,740,850	....	.....	
1889	1,359,645	61,832	679,823[1]	9 per cent. berried
1890	1,612,129	70,909	806,065	
1891	1,292,791	49,973	646,395	
1892	1,107,764	37,230	553,887	
1893	1,149,732	32,741	579,866	
1894	1,096,834	34,897	548,467	6 per cent. nearly
1895	956,365	34,343	478,187	7 per cent. nearly
1896	995,396	30,470	497,698	6 per cent. nearly
1897	896,273	23,719	498,186	
1898	720,413	19,931	360,206	
1899	644,633	16,470	322,316	
1900	646,499	15,638	323,299	
1901	578,383	16,353	289,190	5 per cent.
1902	670,245	....	335,127	
1903	665,466	....	332,733	
1904	552,290	13,950	276,145	
1905	426,471	9,865	213,235	4.6 per cent.
1907[2]	1,039,886	10,348	519,943	2 per cent.
1908[2]	1,035,123	9,081	517,561	
1909[2]	1,326,219	11,656	663,109	
1910[2]	935,356	7,857	467,678	1.6 per cent.

The question to be answered is this: How is it that off the Massachusetts coast in 1910, only about 2 per cent. of the females carried eggs? Even if the figures are not absolutely correct, the general falling off in percentage since 1888 is most marked. In Canada, we have collected no statistics until this year (1916), and Mr. Halkett's returns show that an average of about 97 per cent. carry no eggs. Are these females all sterile? Impossible belief!

For the Canadian coast, therefore, it is clear, that the percentage of females which carry eggs in traps varies from less than 1 per cent. in the Bay of Fundy area (which may be said to include St. Mary's and St. Andrew's) to about 4.2 per cent. in Northumberland Straits; whereas, by mating experiments in these same areas the percentages are increased by an average of 3,000 per cent. in the former and 1,600 per cent. in the latter area.

[1] The estimate of females, as half of the totals is mine.—A. P. K.

[2] Number of lobsters above 9 inches.

Early in our experiments this summer the possibility occurred to me that females in the open sea might in autumn carry more eggs than they do in spring and early summer. In other words, many females might for one reason or another lose their eggs during the winter, and thus reduce the percentage to that elucidated by Mr. Halkett. This possibility was tested to some extent during August and September (1916). Through the courtesy of the Minister of Fisheries, the Hon. J. D. Hazen, I was permitted to fish for lobsters from August 19 to August 31, and found the percentage to 2½ per cent. for the Pictou area. Fishing was again resumed during the last four days of September, when the percentage was found to have increased to 5.6 per cent. Moreover, during September we had 25 males and 25 females confined in the mating pen, and although the enclosure gave way at one corner and allowed some of the lobsters to escape, nevertheless 13½ per cent. of the females were found to have extruded eggs. Here the increase by mating is quite clear.

While I dislike theorizing at this stage in the experiments, I may be permitted to suggest that probably the majority of female lobsters extrude their eggs every year; but that as the total males and females are now greatly reduced through overfishing, and relatively widely separated from each other in the open sea, there is less copulation than formerly, with consequent lack of fertilization of eggs. Being unfertilized the eggs soon "go bad," and drop off. On the other hand, mating brings the sexes together with a resulting increase in the numbers of females carrying fertilized eggs.

We may safely conclude, therefore, that the efficacy of mating as a means of increasing the number of berried females is fairly well established, on the supposition, of course, that the catch of berried females fairly represents the number of berried females in the bottom of the sea. At any rate, the results amply justify further experiments on a large scale, and if further results prove as successful as those of the past three years, they far surpass the results of either lobster hatching or lobster

rearing as a means of conserving the lobster industry.

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THE ROYAL SOCIETY OF CANADA

The thirty-fifth meeting of the Royal Society of Canada was held, this year, in the Chateau Laurier at Ottawa, Province of Ontario, under the presidency of Professor Alfred Baker, M.A., LL.D., of Toronto University. There was a large attendance of fellows from all the provinces of the Dominion. As is well known to readers of Science, this society is essentially national in character; and in the four sections into which the society is divided, the archeological, literary, historical as well as scientific leaders in thought, of English as well as of French Canada, are represented. The society meets but once a year in conclave, but sections can be called at the bidding of its officers to carry out programs of lectures, reading of papers or similar functions with a view of furthering the aims of the society.

Seventeen affiliated societies of Canada reported through their official representatives or delegates. The war now raging in Europe has affected the society to a marked degree, not only in the attendance at the annual meeting owing to the number of fellows serving at the front, but also in the distribution of the publications. There was no distribution to enemy countries.

Death has removed several fellows, including Sir Sandford Fleming; Dr. W. F. King, astronomer; Dr. Samuel E. Dawson, littérateur, historian and geographer, and Monsieur Ernest Gagnon, historian.

The third and fourth sections of the Royal Society of Canada are those specially devoted to the sciences, and papers were presented and read which cover the wide field of research common to all nationalities and special interest to readers of Science.

List of Papers presented in Section III, Chemical and Physical Sciences

Presidential address. By Dr. F. T. Shutt, M.A., F.I.C.—"Agricultural Research in Canada."

"The Turn of Tidal Streams in relation to the Time of the Tide," by W. Bell Dawson, M.A., D.Sc., M.Inst., C.E., F.R.S.C.

"The Smelting of Titaniferous Iron Ores," by Alfred Stansfield, F.R.S.C., D.Sc., A.R.S.M., professor of metallurgy, McGill University, and William Arthur Wissler, M.Sc., of McGill University.

"Factors connecting the Concentration and the Optical Rotatory Power of Aqueous Solutions of Nicotine," by Alfred Tingle and Allan A. Ferguson. Presented by Professor W. R. Lang, F.R.S.C.

"A New Method for the Determination of Nicotine in Tobacco," by Alfred Tingle and Allan A. Ferguson. Presented by Professor W. R. Lang, F.R.S.C.

"The Influence of Fertilizers on the Flow of Water through Soils," by C. J. Lynde, Ph.D., professor of physics, and R. Dougall, B.S.A., research assistant under the Dominion Grant for Agriculture, Macdonald College, P. Q. Presented by Dr. H. T. Barnes, F.R.S.

"On the Initial Charged Condition of the Active Deposits of Radium, Thorium and Actinium," by G. H. Henderson, B.A., B.Sc., instructor in physics, Dalhousie University. Presented by H. L. Bronson, F.R.S.C.

"The Structure of Hailstones of Exceptional Form and Size," by Francis E. Lloyd. Presented by Professor C. H. McLeod, F.R.S.C.

"Human Adipocere," by R. F. Ruttan, M.D., F.R.S.C.

"Formation of Ring Ice or Hoar Frost in Pipes," by Professor H. T. Barnes, F.R.S.C.

"Contact Resistance in Oil," by H. E. Rielley, M.Sc., and Violet Henry, M.Sc. Presented by Professor H. T. Barnes, F.R.S.C.

"The Contact Resistance between Conductors in Relative Motion," by Violet Henry, M.Sc. Presented by Professor H. T. Barnes, F.R.S.C.

"The Solubility of Aluminium Hydroxide in Solutions of Ammonia," by E. H. Archibald and T. Habasian. Presented by Professor Ruttan.

"The Occlusion of Iron by the Ammonium Phosphomolybdate Precipitate," by E. H. Archibald and H. B. Keegan. Presented by Professor Ruttan.

"A Comparison of Radium Standard Solutions," by J. Moran. Presented by Professor A. S. Eve, F.R.S.C.

"The Release of Radium Emanation from Water at Different Temperatures by Bubbling Air through the Solution at a Uniform Rate," by J. Moran. Presented by Professor A. S. Eve, F.R.S.C.

"The Double Salts Formed by Sodium and Potassium Carbonates," by J. W. Bain, F.R.S.C., and C. E. Oliver.

"On the Effect of Stationary Sound Waves on Viscous Flow in Pipes and Channels," by Louis Vessot King, M.A. (Cantab.), D.Sc. (McGill), F.R.S.C., associate professor of physics, McGill University, Montreal.